

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A method of performing an injection operation comprising the steps of:

introducing a water-soluble relative permeability modifier comprising a hydrophobically modified water-soluble polymer into a subterranean formation zone having a permeability to aqueous-based fluids, wherein so that the hydrophobically modified water-soluble polymer ~~is capable of reducing~~ reduces the permeability of the subterranean formation zone to an aqueous-based fluids; and

injecting an aqueous injection fluid into the subterranean formation zone after introducing the water-soluble relative permeability modifier so that the hydrophobically modified water-soluble polymer present in the subterranean formation zone diverts the aqueous injection fluid to another subterranean formation zone.

2. (Original) The method of claim 1 wherein the hydrophobically modified water-soluble polymer has a molecular weight in the range of from about 100,000 to about 10,000,000.

3. (Original) The method of claim 1 wherein the hydrophobically modified water-soluble polymer comprises a polymer backbone comprising polar heteroatoms.

4. (Original) The method of claim 3 wherein the polar heteroatoms present within the polymer backbone of the hydrophobically modified water-soluble polymer comprise oxygen, nitrogen, sulfur, or phosphorous.

5. (Original) The method of claim 1 wherein the hydrophobically modified water-soluble polymer is a reaction product of a hydrophilic polymer and a hydrophobic compound.

6-9. (Cancelled)

10. (Original) The method of claim 5 wherein the hydrophilic polymer comprises a polymer backbone comprising polar heteroatoms.

11. (Original) The method of claim 10 wherein the hydrophilic polymer comprises a cellulose, a chitosan, a polyamide, a polyetheramine, a polyethyleneimine, a polyhydroxyetheramine, a polylysine, a polysulfone, or a starch.

12. (Original) The method of claim 5 wherein the hydrophobic compound comprises an alkyl halide, a sulfonate, a sulfate, or an organic acid derivative.

13. (Original) The method of claim 12 wherein the organic acid derivative comprises an octenyl succinic acid; a dodecenyl succinic acid; or an anhydride, ester, or amide of octenyl succinic acid or dodecenyl succinic acid.

14. (Original) The method of claim 5 wherein the hydrophobic compound has an alkyl chain length of from about 4 to about 22 carbons.

15-20. (Cancelled)

21. (Original) The method of claim 1 wherein the hydrophobically modified water-soluble polymer is prepared from a polymerization reaction of at least one hydrophilic monomer and at least one hydrophobically modified hydrophilic monomer.

22-23. (Cancelled)

24. (Original) The method of claim 21 wherein the mole ratio of the hydrophilic monomer to the hydrophobically modified hydrophilic monomer in the hydrophobically modified water-soluble polymer is in the range of from about 99.98:0.02 to about 90:10.

25. (Currently Amended) The method of claim 1 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a permeability-modifying injection fluid comprising an aqueous injection fluid and the water-soluble relative permeability modifier into the subterranean formation zone.

26. (Original) The method of claim 25 wherein the water-soluble relative permeability modifier is present in the permeability-modifying injection fluid in an amount in the range of from about 0.02% to about 10% by weight of the permeability-modifying injection fluid.

27. (Original) The method of claim 25 wherein the permeability-modifying injection fluid was formed by metering the water-soluble relative permeability modifier into an existing injection stream comprising the aqueous injection fluid to form the permeability-modifying injection fluid.

28. (Currently Amended) The method of claim 1 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a treatment fluid comprising the water-soluble relative permeability modifier into the subterranean formation zone.

29. (Original) The method of claim 28 wherein the water-soluble relative permeability modifier is present in the treatment fluid in an amount in the range of from about 0.02% to about 10% by weight of the treatment fluid.

30-98. (Cancelled)

99. (New) The method of claim 1 wherein the hydrophobically modified polymer is a hydrophilic polymer comprising alkyl chains from 4 to 22 carbons incorporated therein.

100. (New) The method of claim 5 wherein the hydrophilic polymer comprises a dialkyl amino pendant group.

101. (New) The method of claim 5 wherein the hydrophilic polymer comprises a dimethyl amino pendant group and at least one monomer comprising dimethylaminoethyl methacrylate or dimethylaminopropyl methacrylamide.

102. (New) The method of claim 5 wherein the hydrophilic polymer comprises a polyvinylamine, a poly(vinylamine/vinyl alcohol), or an alkyl acrylate polymer.

103. (New) The method of claim 5 wherein the hydrophilic polymer comprises polydimethylaminoethyl methacrylate, polydimethylaminopropyl methacrylamide, poly(acrylamide/dimethylaminoethyl methacrylate), poly(acrylic acid/dimethylaminoethyl methacrylate), poly(methacrylic acid/dimethylaminoethyl methacrylate), poly(2-acrylamido-2-methyl propane sulfonic acid/dimethylaminoethyl methacrylate), poly(acrylamide/dimethylaminopropyl methacrylamide), poly(acrylic acid/dimethylaminopropyl methacrylamide), or poly(methacrylic acid/dimethylaminopropyl methacrylamide).

104. (New) The method of claim 21 wherein the hydrophilic monomer comprises acrylamide; 2-acrylamido-2-methyl propane sulfonic acid; N,N-dimethylacrylamide; vinyl pyrrolidone; dimethylaminoethyl methacrylate; acrylic acid; dimethylaminopropylmethacrylamide; vinyl amine; vinyl acetate; trimethylammoniummethyl methacrylate chloride; methacrylamide; hydroxyethyl acrylate; vinyl sulfonic acid; vinyl phosphonic acid; methacrylic acid; vinyl caprolactam; N-vinylformamide; N,N-diallylacetamide; dimethyldiallyl ammonium halide; itaconic acid; styrene sulfonic acid; methacrylamidoethyltrimethyl ammonium halide; a quaternary salt derivative of acrylamide; or a quaternary salt derivative of acrylic acid.

105. (New) The method of claim 21 wherein the hydrophobically modified hydrophilic monomer comprises an alkyl acrylate, an alkyl methacrylate, an alkyl acrylamide, an alkyl methacrylamide, an alkyl dimethylammoniummethyl methacrylate halide, or an alkyl dimethylammoniumpropyl methacrylamide halide, wherein the alkyl groups have from about 4 to about 22 carbon atoms.

106. (New) A method of performing an injection operation comprising the steps of:
introducing a relative permeability modifier comprising a hydrophobically modified water-soluble polymer into a subterranean formation zone having a permeability to aqueous-based fluids, wherein the hydrophobically modified water-soluble polymer reduces the permeability of the subterranean formation zone to aqueous-based fluids without substantially reducing a permeability of the subterranean formation zone to hydrocarbons; and
introducing an aqueous injection fluid into the subterranean zone, wherein the hydrophobically modified water-soluble polymer present in the subterranean formation zone diverts the aqueous injection fluid to a second subterranean formation zone so that the aqueous injection fluid drives hydrocarbons present in the second subterranean formation zone to one or more production wells.

107. (New) The method of claim 106 wherein the hydrophobically modified polymer is a hydrophilic polymer comprising alkyl chains from 4 to 22 carbons incorporated therein.

108. (New) The method of claim 106 wherein the hydrophobically modified water-soluble polymer has a molecular weight in the range of from about 100,000 to about 10,000,000.

109. (New) The method of claim 106 wherein the hydrophobically modified water-soluble polymer comprises a polymer backbone comprising polar heteroatoms.

110. (New) The method of claim 109 wherein the polar heteroatoms present within the polymer backbone of the hydrophobically modified water-soluble polymer comprise oxygen, nitrogen, sulfur, or phosphorous.

111. (New) The method of claim 107 wherein the hydrophobically modified water-soluble polymer is a reaction product of a hydrophilic polymer and a hydrophobic compound.

112. (New) The method of claim 111 wherein the hydrophilic polymer comprises a dialkyl amino pendant group.

113. (New) The method of claim 111 wherein the hydrophilic polymer comprises a dimethyl amino pendant group and at least one monomer comprising dimethylaminoethyl methacrylate or dimethylaminopropyl methacrylamide.

114. (New) The method of claim 111 wherein the hydrophilic polymer comprises a polyvinylamine, a poly(vinylamine/vinyl alcohol), or an alkyl acrylate polymer.

115. (New) The method of claim 111 wherein the hydrophilic polymer comprises polydimethylaminoethyl methacrylate, polydimethylaminopropyl methacrylamide, poly(acrylamide/dimethylaminoethyl methacrylate), poly(acrylic acid/dimethylaminoethyl methacrylate), poly(methacrylic acid/dimethylaminoethyl methacrylate), poly(2-acrylamido-2-methyl propane sulfonic acid/dimethylaminoethyl methacrylate), poly(acrylamide/dimethylaminopropyl methacrylamide), poly(acrylic acid/dimethylaminopropyl methacrylamide), or poly(methacrylic acid/dimethylaminopropyl methacrylamide).

116. (New) The method of claim 111 wherein the hydrophilic polymer comprises a cellulose, a chitosan, a polyamide, a polyetheramine, a polyethyleneimine, a polyhydroxyetheramine, a polylysine, a polysulfone, or a starch.

117. (New) The method of claim 111 wherein the hydrophobic compound comprises an alkyl halide, a sulfonate, a sulfate, or an organic acid derivative.

118. (New) The method of claim 117 wherein the hydrophobic compound comprises the organic acid derivative, the organic acid derivative comprising an octenyl succinic acid; a dodecenyl succinic acid; or an anhydride, ester, or amide of octenyl succinic acid or dodecenyl succinic acid.

119. (New) The method of claim 111 wherein the hydrophobic compound has an alkyl chain length of from about 4 to about 22 carbons.

120. (New) The method of claim 106 wherein the hydrophobically modified water-soluble polymer is prepared from a polymerization reaction of at least one hydrophilic monomer and at least one hydrophobically modified hydrophilic monomer.

121. (New) The method of claim 120 wherein the hydrophilic monomer comprises acrylamide; 2-acrylamido-2-methyl propane sulfonic acid; N,N-dimethylacrylamide; vinyl pyrrolidone; dimethylaminoethyl methacrylate; acrylic acid; dimethylaminopropylmethacrylamide; vinyl amine; vinyl acetate; trimethylammoniummethyl methacrylate chloride; methacrylamide; hydroxyethyl acrylate; vinyl sulfonic acid; vinyl phosphonic acid; methacrylic acid; vinyl caprolactam; N-vinylformamide; N,N-diallylacetamide; dimethyldiallyl ammonium halide; itaconic acid; styrene sulfonic acid; methacrylamidoethyltrimethyl ammonium halide; a quaternary salt derivative of acrylamide; or a quaternary salt derivative of acrylic acid.

122. (New) The method of claim 120 wherein the hydrophobically modified hydrophilic monomer comprises an alkyl acrylate, an alkyl methacrylate, an alkyl acrylamide, an alkyl methacrylamide, an alkyl dimethylammoniummethyl methacrylate halide, or an alkyl dimethylammoniumpropyl methacrylamide halide, wherein the alkyl groups have from about 4 to about 22 carbon atoms.

123. (New) The method of claim 120 wherein the mole ratio of the hydrophilic monomer to the hydrophobically modified hydrophilic monomer in the hydrophobically modified water-soluble polymer is in the range of from about 99.98:0.02 to about 90:10.

124. (New) The method of claim 107 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a permeability-modifying injection fluid comprising an aqueous injection fluid and the water-soluble relative permeability modifier into the subterranean formation zone.

125. (New) The method of claim 124 comprising metering the water-soluble relative permeability modifier into an existing injection stream comprising the aqueous injection fluid to form the permeability-modifying injection fluid.

126. (New) The method of claim 106 wherein the water-soluble relative permeability modifier is introduced into the subterranean formation zone by injecting a treatment fluid comprising the water-soluble relative permeability modifier into the subterranean formation.

127. (New) A method of performing an injection operation comprising the steps of:
introducing a hydrophobically modified water-soluble polymer into a subterranean formation zone having a permeability to aqueous-based fluids, wherein the hydrophobically modified water-soluble polymer reduces the permeability of the subterranean formation zone to aqueous-based fluids; and
introducing an aqueous injection fluid into the subterranean formation zone.

128. (New) The method of claim 127 wherein the hydrophobically modified polymer is a hydrophilic polymer comprising alkyl chains from 4 to 22 carbons incorporated therein.

129. (New) The method of claim 127 wherein the hydrophobically modified water-soluble polymer has a molecular weight in the range of from about 100,000 to about 10,000,000.

130. (New) The method of claim 127 wherein the hydrophobically modified water-soluble polymer comprises a polymer backbone comprising polar heteroatoms.

131. (New) The method of claim 130 wherein the polar heteroatoms present within the polymer backbone of the hydrophobically modified water-soluble polymer comprise oxygen, nitrogen, sulfur, or phosphorous.

132. (New) The method of claim 127 wherein the hydrophobically modified water-soluble polymer is a reaction product of a hydrophilic polymer and a hydrophobic compound.

133. (New) The method of claim 127 wherein the hydrophilic polymer comprises a dialkyl amino pendant group.

134. (New) The method of claim 127 wherein the hydrophilic polymer comprises a dimethyl amino pendant group and at least one monomer comprising dimethylaminoethyl methacrylate or dimethylaminopropyl methacrylamide.

135. (New) The method of claim 127 wherein the hydrophilic polymer comprises a polyvinylamine, a poly(vinylamine/vinyl alcohol), or an alkyl acrylate polymer.

136. (New) The method of claim 127 wherein the hydrophilic polymer comprises polydimethylaminoethyl methacrylate, polydimethylaminopropyl methacrylamide, poly(acrylamide/dimethylaminoethyl methacrylate), poly(acrylic acid/dimethylaminoethyl methacrylate), poly(methacrylic acid/dimethylaminoethyl methacrylate), poly(2-acrylamido-2-methyl propane sulfonic acid/dimethylaminoethyl methacrylate), poly(acrylamide/dimethylaminopropyl methacrylamide), poly(acrylic acid/dimethylaminopropyl methacrylamide), or poly(methacrylic acid/dimethylaminopropyl methacrylamide).

137. (New) The method of claim 132 wherein the hydrophilic polymer comprises a cellulose, a chitosan, a polyamide, a polyetheramine, a polyethyleneimine, a polyhydroxyetheramine, a polylysine, a polysulfone, or a starch.

138. (New) The method of claim 132 wherein the hydrophobic compound comprises an alkyl halide, a sulfonate, a sulfate, or an organic acid derivative.

139. (New) The method of claim 138 wherein the hydrophobic compound comprises the organic acid derivative, the organic acid derivative comprising an octenyl succinic acid; a dodecenyl succinic acid; or an anhydride, ester, or amide of octenyl succinic acid or dodecenyl succinic acid.

140. (New) The method of claim 132 wherein the hydrophobic compound has an alkyl chain length of from about 4 to about 22 carbons.

141. (New) The method of claim 127 wherein the hydrophobically modified water-soluble polymer is prepared from a polymerization reaction of at least one hydrophilic monomer and at least one hydrophobically modified hydrophilic monomer.

142. (New) The method of claim 131 wherein the hydrophilic monomer comprises acrylamide; 2-acrylamido-2-methyl propane sulfonic acid; N,N-dimethylacrylamide; vinyl pyrrolidone; dimethylaminoethyl methacrylate; acrylic acid; dimethylaminopropylmethacrylamide; vinyl amine; vinyl acetate; trimethylammoniummethyl methacrylate chloride; methacrylamide; hydroxyethyl acrylate; vinyl sulfonic acid; vinyl phosphonic acid; methacrylic acid; vinyl caprolactam; N-vinylformamide; N,N-diallylacetamide; dimethyldiallyl ammonium halide; itaconic acid; styrene sulfonic acid; methacrylamidoethyltrimethyl ammonium halide; a quaternary salt derivative of acrylamide; or a quaternary salt derivative of acrylic acid.

143. (New) The method of claim 141 wherein the hydrophobically modified hydrophilic monomer comprises an alkyl acrylate, an alkyl methacrylate, an alkyl acrylamide, an alkyl methacrylamide, an alkyl dimethylammoniummethyl methacrylate halide, or an alkyl dimethylammoniumpropyl methacrylamide halide, wherein the alkyl groups have from about 4 to about 22 carbon atoms.

144. (New) The method of claim 141 wherein the mole ratio of the hydrophilic monomer to the hydrophobically modified hydrophilic monomer in the hydrophobically modified water-soluble polymer is in the range of from about 99.98:0.02 to about 90:10.

145. (New) The method of claim 127 wherein the hydrophobically modified water-soluble polymer present in the subterranean formation zone diverts the aqueous injection fluid to a second subterranean formation zone.